DSA Review & Acceptance Procedures - Manufactured Earthquake Bracing Systems for Residential Water Heaters

Any manufacturer of an earthquake bracing system for residential water heaters may submit an application to the Division of the State Architect (DSA) for review and acceptance of the system. DSA's acceptance is based upon conformance with the applicable requirements of the California Building Code and California Plumbing Code (effective editions at the date of application). An application for DSA review must include each of the following items:

- Completed application form and fee (see page 2, application form is on page 5).
- Bracing system drawings and specifications (see page 2).
- Sample specimen of the bracing system and installation instructions (see page 2).
- Test report prepared by a DSA-qualified laboratory (see pages 3 and 4).

Earthquake Bracing System - A bracing or strapping system that prevents the overturning or excessive movement of a residential water heater. The maximum capacity of the water heater for which the system is designed and has been tested shall be stated on the manufacturer's packaging and installation instructions.

Review - DSA's review of the application, including the drawings and specifications, the sample specimen, and the test report issued by a DSA-qualified testing laboratory.

Accepted Method or DSA Acceptance - Written notification by DSA indicating that the bracing system has been accepted for earthquake bracing of residential water heaters. This notification is issued for each application, when DSA's review has been completed and the bracing system is deemed to comply with code requirements.

Limitations of DSA Acceptance

The DSA review and acceptance is limited to the earthquake bracing system identified within the application and shall not extend to any other product. DSA acceptance does not expire unless invalidated by DSA.

Any material change to the bracing system renders DSA's acceptance invalid, unless DSA has specifically reviewed and accepted the modification. If DSA determines that the modification does not warrant new testing, a new application may not be required.

Manufacturers may indicate on the bracing system packaging and within the installation instructions that the product has been reviewed by DSA and is an "accepted method" for water heater earthquake bracing. A manufacturer must only represent the "accepted method" as defined by DSA, otherwise DSA acceptance of the manufacturer's product may be voided.

DSA reserves the right to disclose or publish all or any part of a submitted test report or technical data relating to an "accepted method" bracing system.

DSA Contact Information

Division of the State Architect
1130 K Street, Suite 101
Sacramento, CA 95814

Contact person: Terence Fong
phone 916.324.7099 fax 916.327.3371
Email: terence.fong@dgs.ca.gov
www.dgs.ca.gov/dsa

Application and Fee

Each application for DSA review must include a completed application form and payment of a $500 application fee. A separate application and fee is required for each different bracing system size or configuration. The application fee shall be retained by DSA to offset costs incurred through evaluation of the test reports and technical data, whether or not the system is found to be in conformance with the DSA requirements.

In the event that DSA can not issue a notification of acceptance to the manufacturer, the manufacturer will be notified of any outstanding issues that must be satisfactorily addressed in order to obtain DSA acceptance.

Bracing System Drawings & Specifications

Drawings and specifications for the bracing system must be provided with the application. Drawings must indicate the bracing configuration and any attachments to the water heater and supporting walls. Drawings must also indicate the size and thickness of all bracing or strapping members, and the type and size of all fasteners. The material type and grade must be specified for all bracing or strapping members and fasteners.

Sample Specimen

A sample specimen of the bracing system, randomly chosen from the production line, must be submitted to DSA with the application. The specimen must include all components and fasteners used in the bracing system. A copy of the manufacturer's installation instructions must be submitted with the sample specimen.

Testing and Test Report Requirements

Qualified Testing Laboratories

The manufacturer must utilize a DSA-qualified testing laboratory to conduct the required tests and to prepare the test report submitted with the application. A list of DSA-qualified testing laboratories is provided on page four of this publication.

DSA qualification of the test laboratory is based on the following criteria:

- The laboratory must be equipped to perform static and dynamic tests in accordance with DSA requirements (see page 3).
- The laboratory must be staffed with personnel who are qualified to conduct such testing. Qualified personnel shall perform or supervise the performance of all testing and shall so certify to DSA on the test report. Evidence of such qualification includes registration as a civil, structural, mechanical or quality control engineer.
- A testing laboratory can not have any financial interest in any company manufacturing or distributing any portion of any product to be tested. The testing laboratory can not be owned, operated or controlled by any company manufacturing or distributing any portion of the product to be tested.

DSA qualification of a testing laboratory does not expire unless such qualification has been rescinded by DSA for cause. Testing laboratories can apply for qualification by contacting DSA (see page 1 for contact information).

Testing

The bracing system specimens submitted to the laboratory for testing shall be representative samples of the manufactured product. The bracing system must have both static load tests and dynamic load tests performed by the testing laboratory. The test fixture shall include a wood stud wall (straight segment of wall with gypsum board sheathing), the water heater (of a specified size), and the bracing system (installed in accordance with the manufacturer's published installation instructions).

Static Testing

A minimum of two static load tests must be performed. One test must have the horizontal load applied in a direction perpendicular to the supporting wall, and another test must have the horizontal load applied in a direction parallel to the supporting wall. The horizontal load is to be applied in increments of 20% of the maximum applied load.

The maximum applied load is equal to 2.0 times the minimum static design load prescribed by the 1997 edition of the Uniform Building Code (UBC).

The minimum static design load (allowable stress design) based on Formula 32-2 in Section 1632 of the 1997 UBC is $F_p = 0.40\ W_p$ based on the following factors:

seismic zone factor Z = .4, $C_a = .44N_a$, $N_a = .1.5$ (< 2 km from seismic source type A)

$a_p = 1.0$, $R_p = 3.0$, $I_p = 1.0$

$h_x / h_r = .5$ (approximate), assuming the water heater is located at the second floor level of a multi-story residential structure. This results in a higher design load than if the water heater is located at the first floor of a multi-story or single story residential structure.

Dynamic Testing

A minimum of two dynamic tests must be performed, utilizing a shake table. One test must have the horizontal input loading applied in a direction perpendicular to the supporting wall, and another test must have the load applied in a direction parallel to the supporting wall.

Seismic input loading shall be based on the 1997 edition UBC, utilizing Section 6.5.1.1 of the *Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components* (AC156, dated January 2000). AC156 is available at www.icbo.org, click on "building products", then click on "acceptance criteria".

Formula coefficients are as prescribed above under static testing. Test procedures may be conducted in accordance with Section 6.0 (Seismic Qualification Test Procedure) of AC156.

Test Report Requirements

The test report must include the following information:

- Static load and dynamic load parameters, derived RRS (required response spectrum) levels.
- Description of testing equipment for both static and dynamic (shake table) tests.
- Description of measurement instrumentation and test protocols for both static and dynamic tests.
- Test data, including proof of performance, test response spectrum plots, acceleration time histories of the shake table input motion, transmissibility plots, etc.
- Test results and conclusions.
- Manufacturer's published installation instructions for the earthquake bracing system.

DSA-Qualified Testing Laboratories
for Testing of
Earthquake Bracing Systems for Water Heaters

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ANCO Engineers, Inc. Contact: George Howard

4826 Sterling Drive
Boulder, CO 80301

phone (303) 443-7580
fax (303) 443-8034

National Technical System Contact: BettyM@NTSCorp.com

contact - Betty Matteson
1536 East Valencia Drive P.O. Box 4158
Fullerton, CA 92831

phone (714) 879-6110
fax (714) 879-6117

Wyle Laboratories Contact: Kanderson@NOR.WyleLabs.com

contact - Keith Anderson
1841 Hillside Avenue
Norco, CA 91760

phone (909) 737-0871
fax (909) 737-7549

CSA International Contact: Jerry.Moore@CSA-international.org

contact - Steve Dudden
2805 Barranca Parkway
Irvine, CA 92606-5114

phone (949) 733-4300
fax (949)733-4320

State of California • Department of General Services • Gray Davis, Governor
DIVISION OF THE STATE ARCHITECT
Headquarters • 1130 K Street, Suite 101 • Sacramento, CA 95814 • (916) 445-8100

Application for DSA Review and Acceptance
Earthquake Bracing System for Water Heaters

Manufacturer:

Manufacturer's Representative:

Address:

Number Street

City State Zip

( ) ( )

Telephone Number Fax Number

Application is hereby made for review of:

Bracing System Model Name:

Maximum Water Heater Capacity:

Tested By:

Testing Laboratory:

Address:

Number Street

City State Zip

( ) ( )

Telephone Number Fax Number

Manufacturer and capacity of water heater used in tests:

Test Report: **Test Date:**

Test By: **Title:**

DSA Acceptance:

Signature Title Date

A $500 fee shall accompany this application. If the actual cost of processing this application exceeds this amount, the additional costs must be paid by the applicant before the DSA acceptance can be issued. Checks shall be made payable to: Division of the State Architect.